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NASA LAUNCH SERVICES PROGRAM

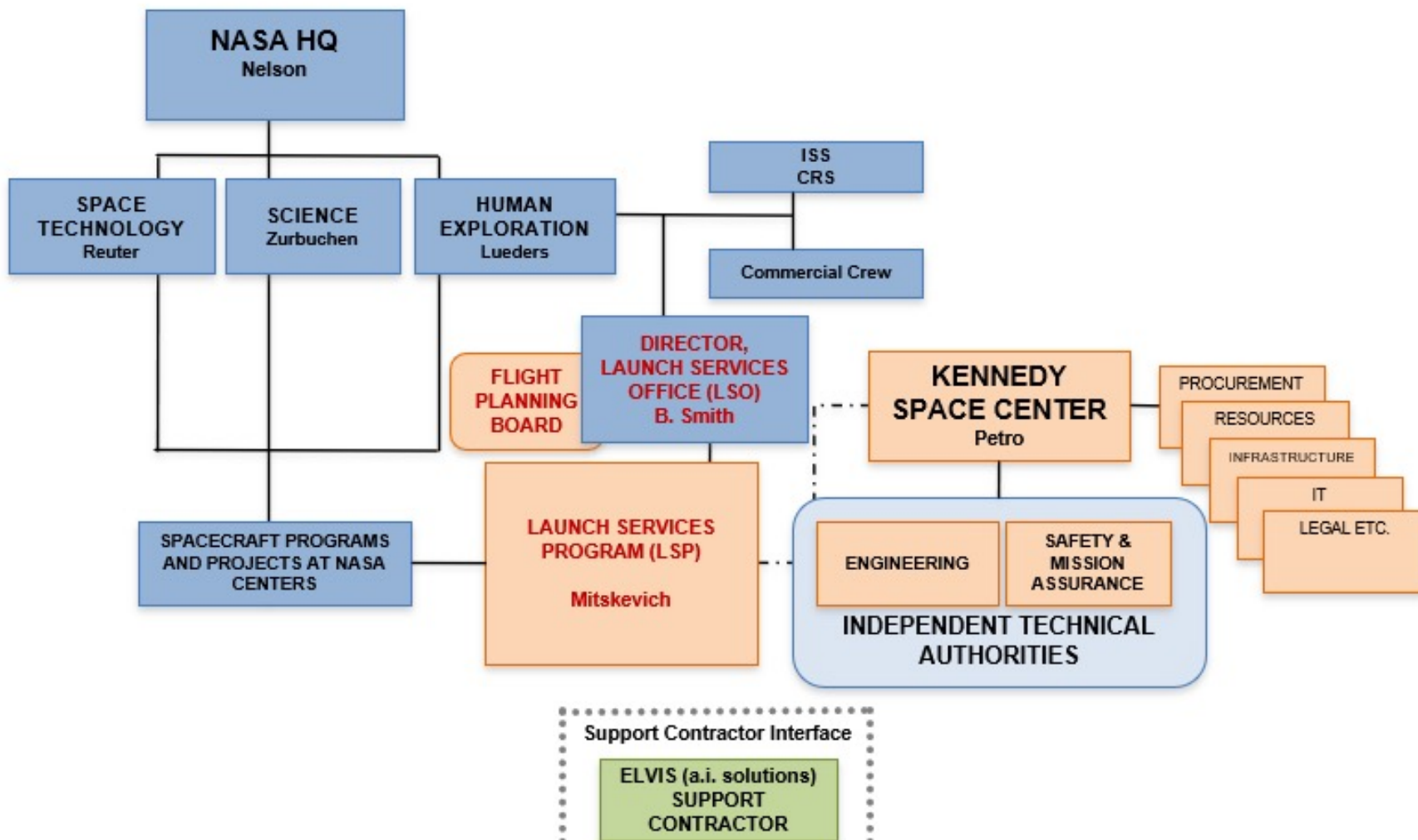
**ASTROPHYSICS EXPLORERS MIDEX 2021
PREPROPOSAL CONFERENCE
SEPTEMBER 14, 2021**

**Shaun Daly
Flight Projects Office**



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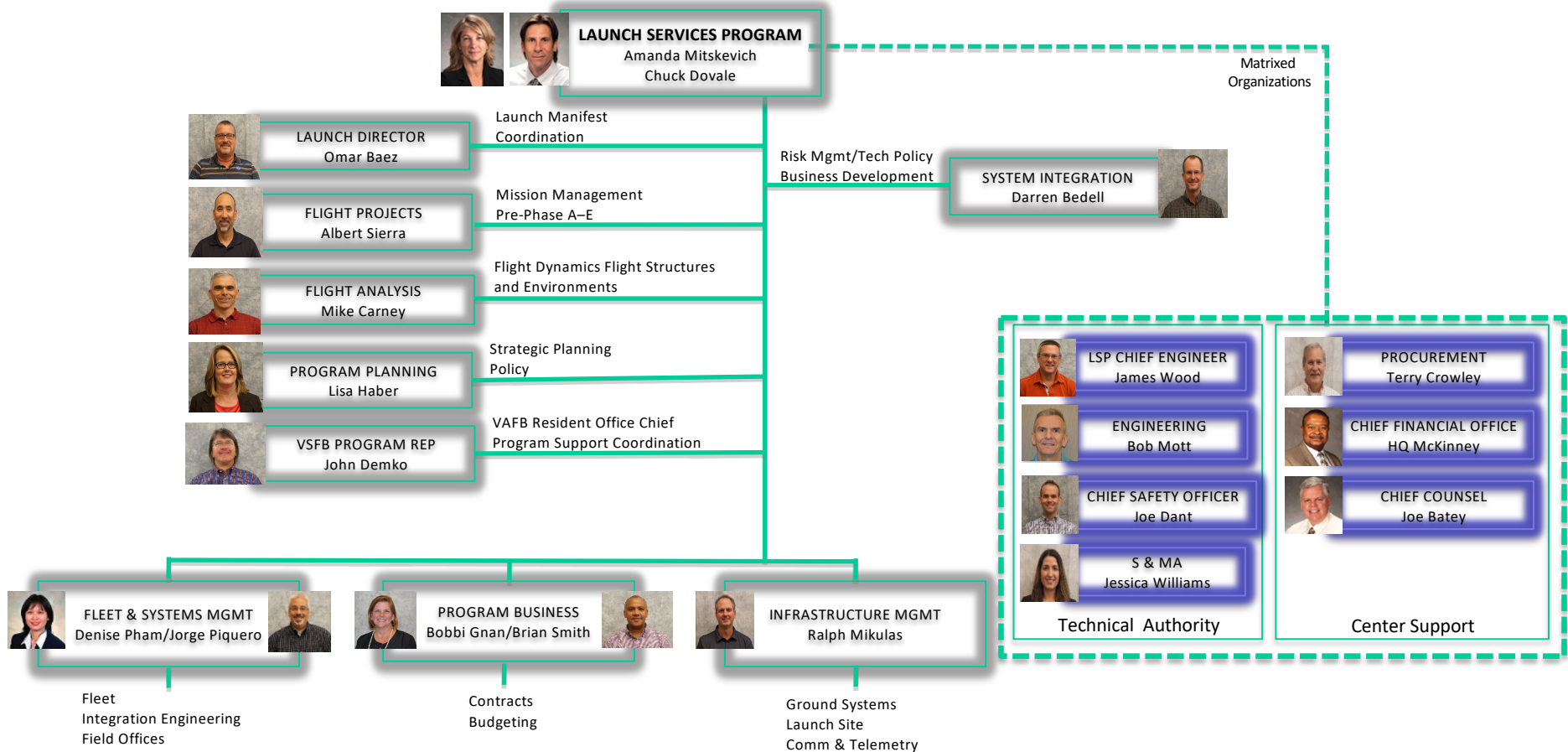
Launch Services Program Relationships (NASA/HEOMD/KSC)





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LSP Organizational Structure





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Launch Services Program



The Launch Services Program (LSP) provides:

- **Procurement and management of the launch service**
- **Technical insight/approval of the launch vehicle (LV) production/test**
 - **Mission Management and engineering support**
 - **Oversight (approval) of mission unique launch vehicle hardware/software development**
- **Launch campaign/countdown management – formal readiness reviews**
- **Risk management for launch service**
- **Payload-processing accommodations**
- **Downrange telemetry assets for launch vehicle data**



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Launch Services Program



NASA Strategic Plan 2014

Strategic Goal 3:

Serve the American public and accomplish our Mission by effectively managing our people, technical capabilities, and infrastructure.



Objective 3.2:

Ensure the availability and continued advancement of strategic, technical, and programmatic capabilities to sustain NASA's Mission



Key Strategy:

Provide access to space

Lead Office: **HEOMD**

Contributing Program: **LSP**

Key Strategy "Provide access to space" citation:

"...certify and procure domestic commercial space transportation services for the launch of robotic science, communication, weather, and other civil sector missions"

"...provide robust, reliable, commercial and cost-effective launch services"

"...assured access to space through a competitive 'mixed Fleet' approach utilizing the breadth of U.S. industry's capabilities"



LSP Strategic Goals 2014

Goal 1: Maximize Mission Success

Goal 2: Assure Long-Term Launch Services

Goal 3: Promote Evolution of a U.S. Commercial Space Launch Market

Goal 4: Continually Enhance LSP's Core Capabilities





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LSP Functional Structure



- **LSP procures/provides a Launch Service**
 - Its more than the basic launch vehicle
 - We don't buy a tail number
 - This is a commercial FFP procurement with additional insight and oversight
- **To enable this, LSP has two functional sides**
 - **Mission integration**
 - » Mission Integration Team (MIT) assigned to each mission
 - » Manages mission specific procurement, integration, and analysis
 - » Includes launch site integration and processing
 - **Fleet management**
 - » Personnel assigned to each contracted rocket
 - » Includes resident offices within the production facilities of all active providers
 - » We watch the production and performance of entire fleet – we certify the manufacture's production line, not just a particular unit (tail number)
 - » We have a say in any change/upgrade/anomaly
- **LSP maintains the final go or no-go for launch**
- **Interface with Safety and Mission Assurance**
 - Safety
 - Quality



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Technical Information flow into the MIT

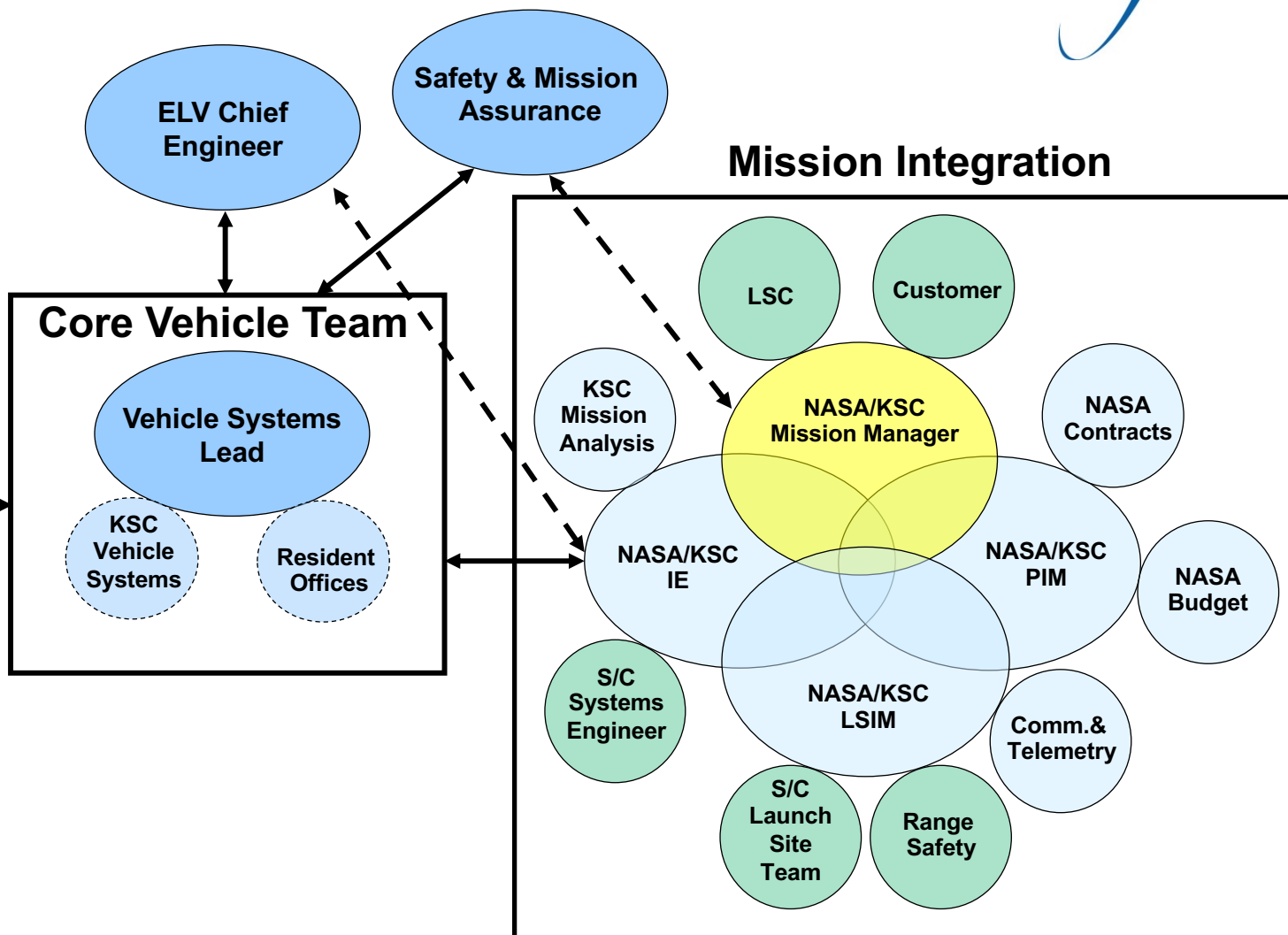


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Core Vehicle Test & Build

Integration & Test Facilities

Integrated Product Teams





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NASA Provided Launch Services



- **The NASA Launch Services (NLS) II Contract is LSP's primary method to acquire all classes of commercial launch services for spacecraft (SC) customers**
- **Provides NASA with domestic launch services that are safe, successful, reliable, and affordable**
- **Provides services for both NASA-Owned and NASA-Sponsored payloads through multiple Indefinite Delivery Indefinite Quantity (IDIQ) Launch Service Task Order (LSTO) contracts with negotiated Not To Exceed (NTE) Prices**
- **Provides services on a Firm-Fixed-Price (FFP) basis**
 - **Incorporates best commercial practices to the maximum extent practical**
 - **Includes Standard and Non-Standard services**
 - **Mission unique modifications**
 - **Special studies**
- **Allows LSP to turn on a Task Assignment or Non-Standard Service at any time for analyses**



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NLS II Contracts Overview



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- **Launch Services Risk Mitigation Policy for NASA-owned and/or NASA-sponsored Payloads/Missions can be found under NPD 8610.7. Document can be found at <http://nodis3.gsfc.nasa.gov>**
 - Risk Category 1: Low complexity and/or low cost payloads-Classified as Class D payloads pursuant to NPR 8705.4
 - Risk Category 2: Moderate complexity and/or moderate cost payloads-Classified as Class C payloads and, in some cases, Class B payloads, pursuant to NPR 8705.4
 - Risk Category 3: Complex and/or high cost payloads-Classified as Class A payloads and, in some cases, Class B payloads, pursuant to NPR 8705.4
- **Each Provider has their own unique Launch Delay Table**
 - Delay terms are identical for both parties (Contractor/NASA)
 - **No-fault Launch delays**
 - » Include: range constraints, floods, acts of God, strikes and other conditions
 - » No adjustment made to mission price
 - » No limit on number of days
- **For the remaining delay cases grace days are based on sliding scale for both Contractor and NASA delays**
 - 150 days of grace at ATP through L-24
 - Sliding down to 7 days of grace at L-10 days



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NLS II Contracts Overview – Cont'd



- **NLS II Launch Service Costs**
 - Acquisition process begins at approximately L-36 months
 - Authority to Proceed (ATP) concurrent with Task Order Award at approximately L-30 months

- **The standard launch service includes:**
 - Procurement and management (including risk management) of the launch service, technical insight/approval of the launch vehicle production/test and mission unique launch vehicle hardware/software development
 - » Engineering, analysis, and minimum performance standards and services provided by the contract (insight and approval)
 - Mission integration management
 - Launch site payload processing facility and support, logistics, hazardous support
 - Range support and services, contractor engineering support, base support contracts
 - Down Range Telemetry support (launch vehicle only)
 - Launch campaign/countdown management – formal readiness reviews
- **Mission Uniques already budgeted for are items like Pre-ATP studies such as coupled loads and/or trajectories analysis, payload isolation system, a GN2 or pure air purge prior to T-0 and 10,000 Class integration environment.**



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Launch Service Budget



- **The standard launch service includes:**
 - **Procurement and management (including risk management) of the launch service, technical insight/approval of the launch vehicle production/test and mission unique launch vehicle hardware/software development**
 - » **Engineering, analysis, and minimum performance standards and services provided by the contract (insight and approval)**
 - **Mission integration management**
 - **Launch site payload processing facility and support, logistics, hazardous support**
 - **Range support and services, contractor engineering support, base support contracts**
 - **Down Range Telemetry support (launch vehicle only)**
 - **Launch campaign/countdown management – formal readiness reviews**
- **There is no charge to the PI-Managed Cost for the use of low-level radioactive sources (i.e., with an A2 mission multiple less than 10, as defined in NPR 8715.3, Chapter 6 and Appendix D) as a non-standard service**
- **Mission Uniques already budgeted for are items like Pre-ATP studies such as coupled loads and/or trajectories analysis, payload isolation system, a GN2 or pure air purge prior to T-0 and 10,000 Class integration environment.**



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Launch Service Budget (cont'd)



- **The following non-standard/mission unique launch services are examples of items NOT covered under the LSP budget and cost must be included in the PI-Managed Mission Cost:**
 - Nuclear launch services utilizing a RHU/MMRTG
 - Auxiliary propulsion for target orbit achievement
 - Enhanced contamination control, planetary protection, operational clean enclosures
 - Cameras on the LV to capture spacecraft separation etc...
 - Extended mission integration periods (in excess of 33 months)
 - LV mods/analyses for non-separating interface with multiple SC deployments (separation, trajectory, controls, flight software, etc...)
 - Deployable spacecraft telemetry tracking asset
 - Mission Unique payload adapter
 - LV hardware modifications required to accommodate unique payload configuration
 - Spacecraft or Payload caused Launch delay



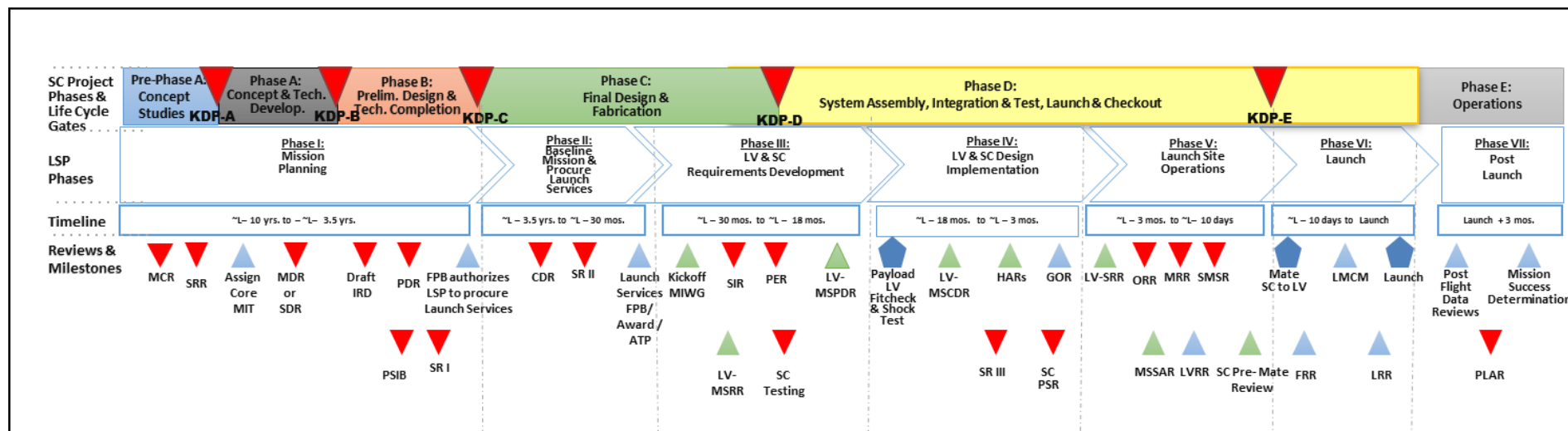
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Launch Vehicle Acquisition



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- The acquisition of the launch service will include a domestic Category 2 or 3 certified launch vehicle procured and managed by the NASA/Launch Services Program (LSP)
- Contributed launch services cannot be proposed or considered under this AO
- The LSP will competitively select a launch service provider for these missions based on customer requirements and NASA Flight Planning Board (FPB) approval.
- Standard launch service provides the performance and volume of a medium class launch vehicle





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Vehicles Projected to be Available Under NLS II



- Performance with reference orbits, Environments, and Fairing Dimensions for candidate launch vehicles for this MIDEX AO available on the NLS II contract are listed in the Launch Services Program Information Summary document
- Assumption of a specific launch vehicle configuration as part of the AO proposal will not guarantee that the proposed LV configuration will be selected
- Proposers are advised to plan for compatibility with all of the medium/intermediate class vehicles that are expected to be available through spacecraft Preliminary Design Review.
 - Payload design should accommodate the three scenario's launch characteristics and capabilities included in "Launch Services Program Information Summary" document
 - If there are areas that are not compatible with the S/C requirements/design, the impacts on the S/C to meet these areas need to be addressed in the proposal

For mission specific information, utilize the LSP performance website and/or the LSP POC.



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Performance Capability Scenarios at Reference Orbits



Scenario 1:

Reference Orbit		Performance (kg)	Volume
LEO	700 km, Sun-Synch	3385	PLF Scenario 1 (re: Fig. 7)
L2	$C_3 = -0.5 \text{ km}^2/\text{s}^2$	1695	PLF Scenario 1
Lunar	$C_3 = -1.8 \text{ km}^2/\text{s}^2$	1750	PLF Scenario 1

Scenario 2:

Reference Orbit		Performance (kg)	Volume
LEO	700 km, Sun-Synch	5620	PLF Scenario 2 (re: Fig. 8)
L2	$C_3 = -0.5 \text{ km}^2/\text{s}^2$	1810	PLF Scenario 2
Lunar	$C_3 = -1.8 \text{ km}^2/\text{s}^2$	1925	PLF Scenario 2

Performance Ground Rules (valid for all scenarios):

- The LV performance available on NLS-II generally does not include impacts associated with orbital debris compliance; this must be evaluated on a mission-specific basis. Depending on LV design, this could result in a significant performance impact to ensure full compliance with orbital debris policy.
- Guidance reserves have been allocated to account for 3-sigma flight performance.
- Performance is for a Baseline LV configuration; non-standard, mission-unique hardware will require additional assessment.
- Assumes a 47-inch (1194 mm) separation system.
- Mass of entire separation system is book-kept on the launch vehicle side.

For mission specific information, utilize the LSP performance website and/or the LSP POC.



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Scenario 1: Mass Performance at Sun-Synchronous Inclination

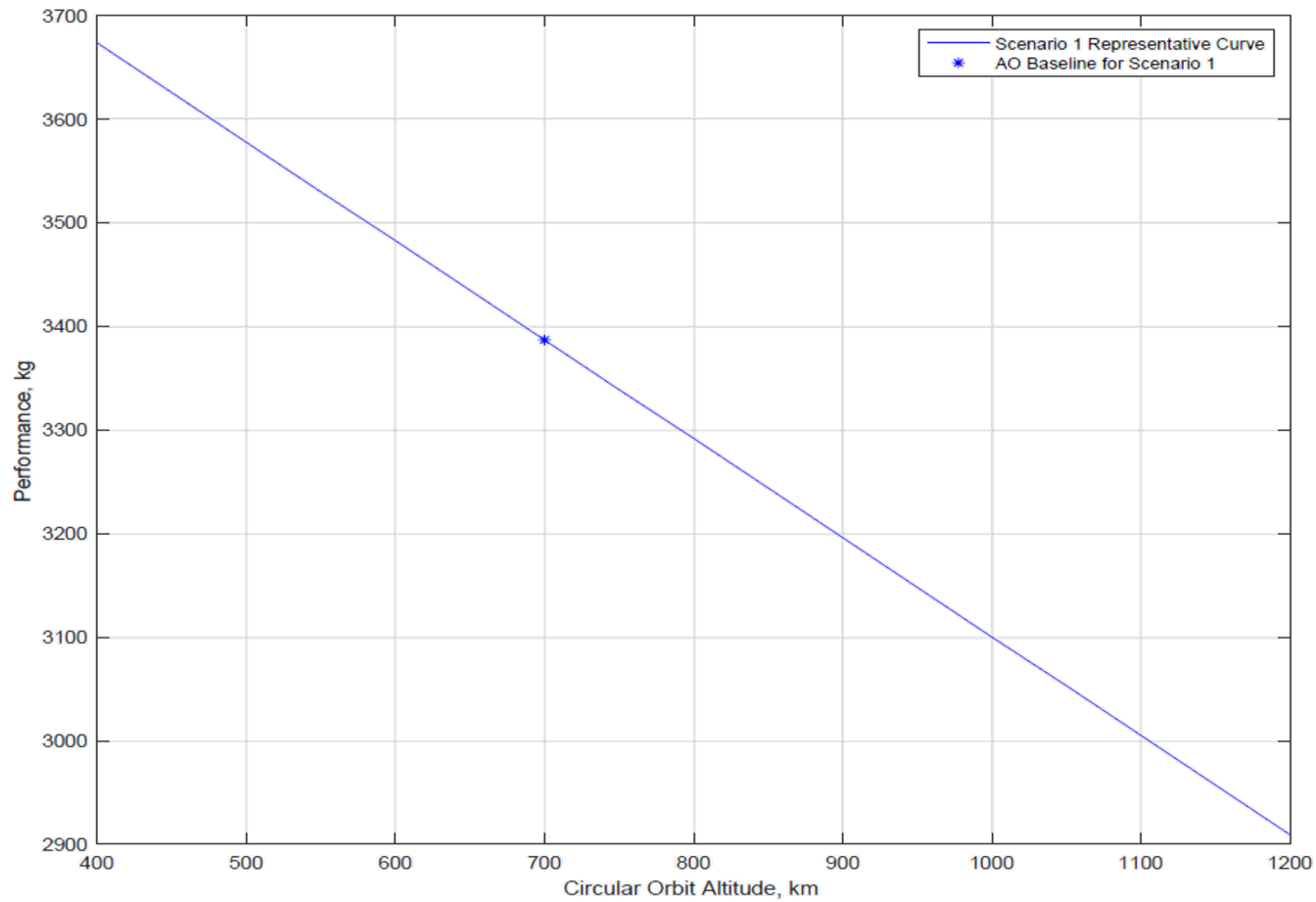


Figure depicts representative nominal performance at Sun-Synchronous inclination. Vehicle injection dispersion capabilities will determine the accuracy of targeting this orbit.



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Scenario 1: Mass Performance to High Energy Orbits

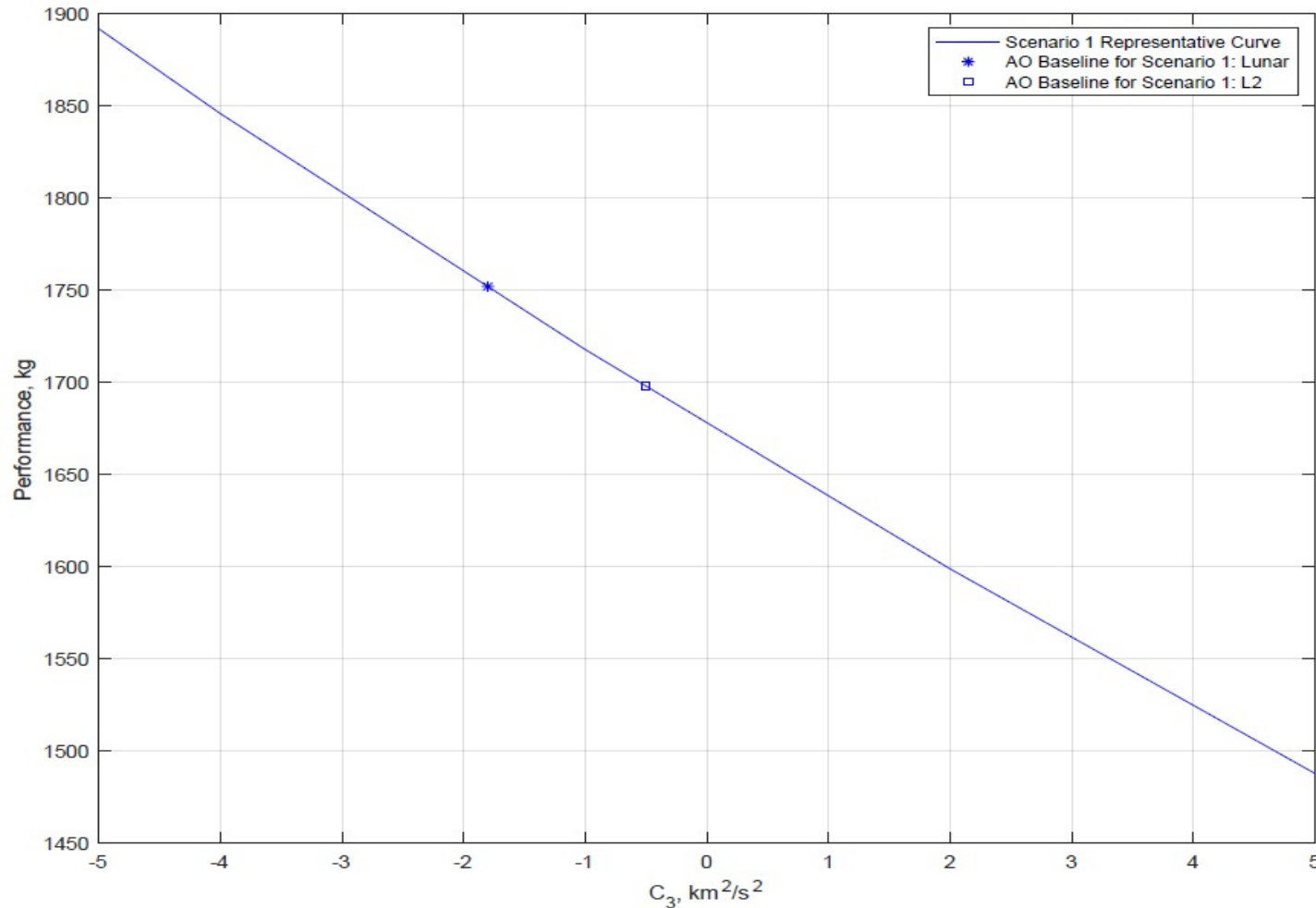


Figure depicts representative nominal performance to High Energy Orbits. Vehicle injection dispersion capabilities will determine the accuracy of targeting these orbits.



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Scenario 2: Mass Performance at Sun-Synchronous Inclination

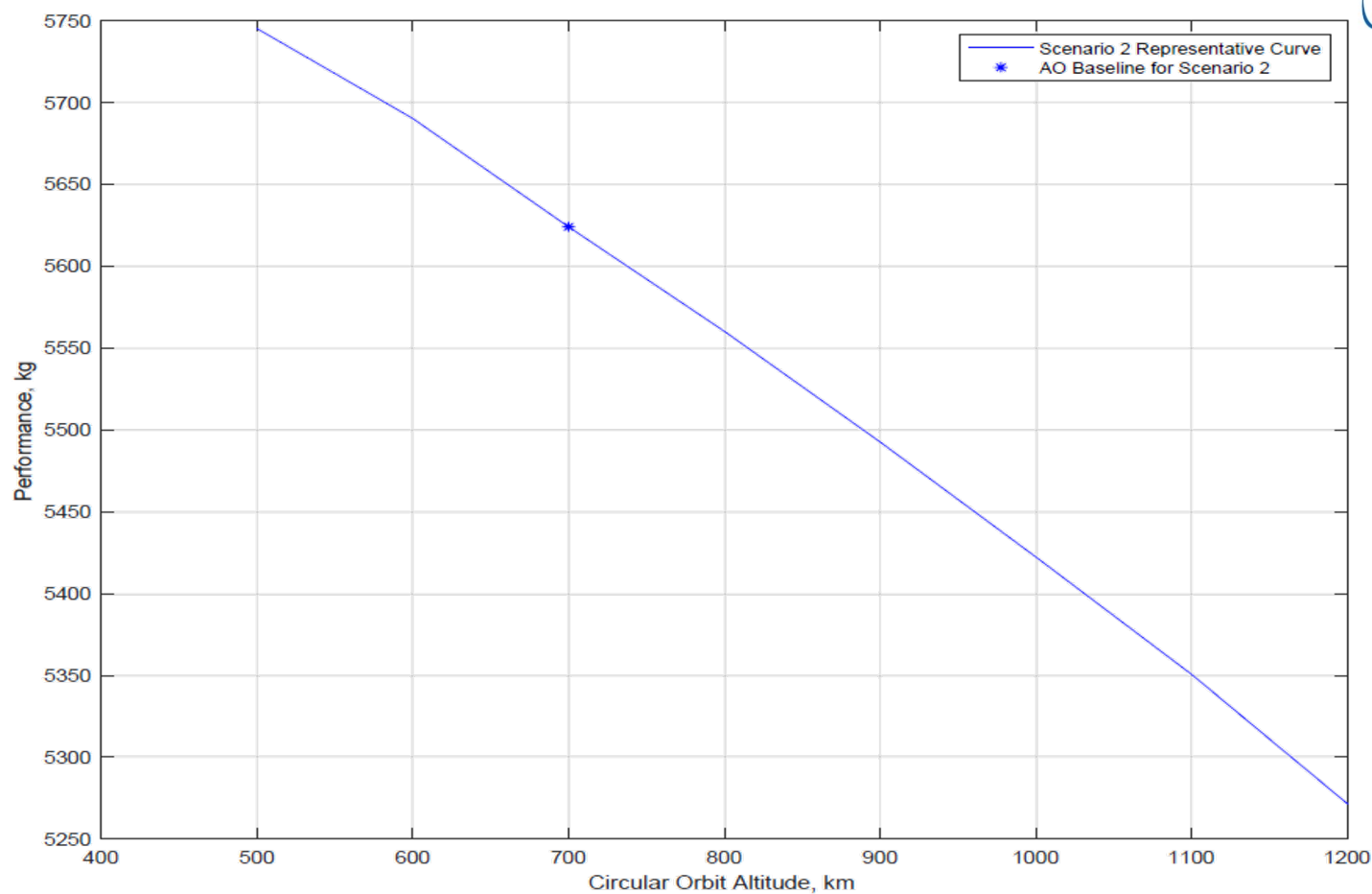


Figure depicts representative nominal performance at Sun-Synchronous inclination. Vehicle injection dispersion capabilities will determine the accuracy of targeting this orbit.



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Scenario 2: Mass Performance to High Energy Orbits

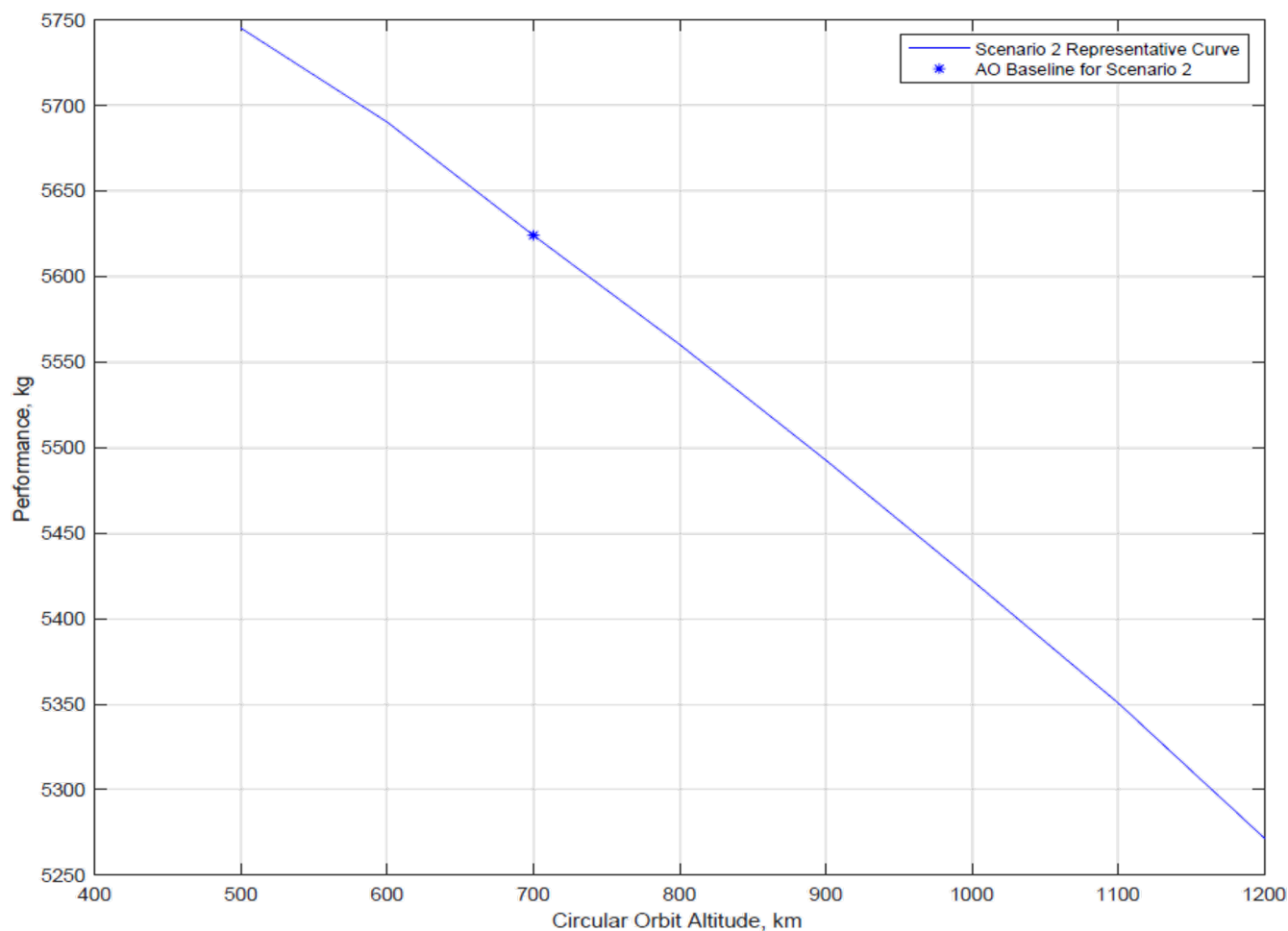
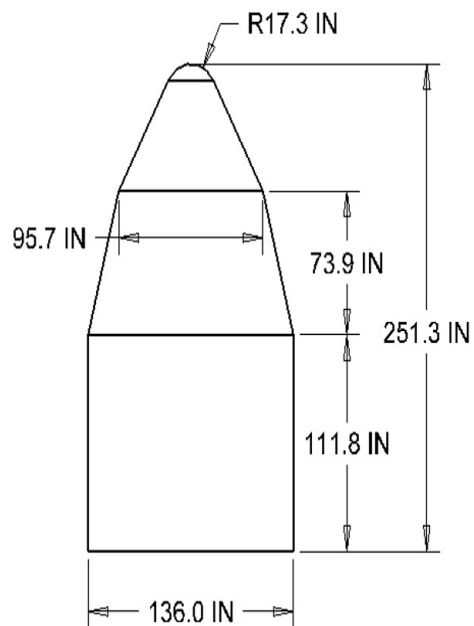


Figure depicts representative nominal performance to High Energy Orbits. Vehicle injection dispersion capabilities will determine the accuracy of targeting these orbits.

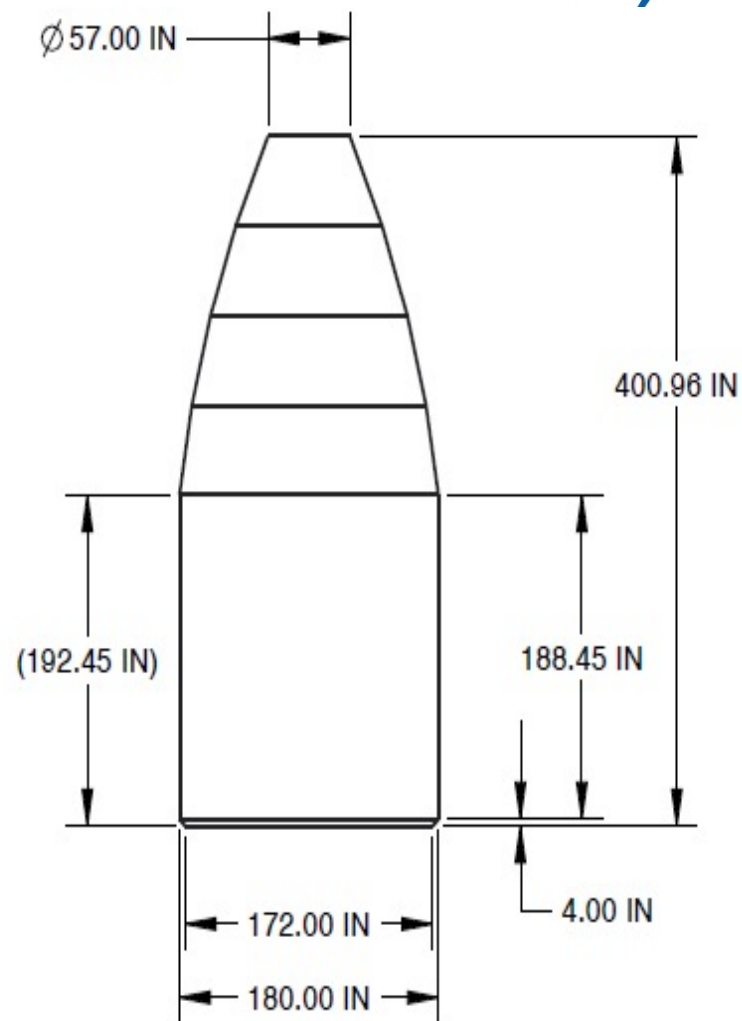


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Payload Fairing Envelopes



Scenario 1 PLF Static Envelope
(inches)



Scenario 2 PLF Static Envelope
(inches)



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Launch Vehicle Enveloping Environments



- **Different payload fairing volume scenarios are depicted for this AO.**
- **Proposals should identify impacts that these scenarios would have on S/C requirements. Include sufficient S/C dimensions to fit within these PLF static envelopes, including any close approaches.**
- **Details regarding launch vehicle environments are found in the Launch Services Program Information Summary (In MDEX AO Program Library)**
 - **Shock**
 - **Equivalent Sine (all scenarios)**
 - **Design Load Factors (all scenarios)**
 - **Payload Acoustics (all scenarios)**



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Summary



- It is the Launch Service Program's goal to ensure the highest practicable probability of mission success while managing the launch service technical capabilities, budget and schedule.
- Questions must be officially submitted to:

Shaun Daly
Mission Manager
NASA Launch Services Program Code VA-C
Kennedy Space Center, FL 32899
Phone: 321-289-6426
Email: shaun.daly@nasa.gov

LSP is ready to respond to your mission specific questions.



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Back Up



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Available Vehicles under NLS II



- **The Agency policy, NPD 8610.7 “Risk Mitigation Policy for NASA-Owned and/or NASA-Sponsored Payloads/Mission”**
 - **Requires one successful launch of vehicle configuration in order to bid for a proposal**
 - **Launch Services Program initiates the procurement of a launch service under the NLS II contract via a Launch Services Task Order (LSTO)**



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LSTO Process



- **HQ Flight Planning Board (FPB) notifies LSP of mission requirement**
 - Launch Services Interface Requirements Document (LSIRD) has already been developed by SC customer & provided to HQ FPB and to LSP (LSP works with SC customer to develop LSIRD)
- **Launch Services Program Manager notifies procurement officer of requirement and provides recommended technical personnel for LSTO evaluation team**
- **Procurement officer establishes LSP evaluation team with designated contracting officer and lead tech evaluator**
 - Note that the team includes up to 2 or 3 reps from the spacecraft project team
- **LSTO evaluation team performs the following:**
 - Develop tech requirements based on mission definition
 - Assures FAR guidelines are being followed
 - Determines and documents LSTO evaluation criteria
 - CO issues Request for Launch Services Proposals (RLSP) to multiple contractors



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LSTO Process (cont'd)



- **LSTO evaluation team performs the following (cont'd):**
 - Evaluate contractor proposals in accordance with LSTO procedures
 - Complete evaluation and brief to procurement officer, LSP Program Manager, FPB, sponsoring Program/Project on evaluation results
 - Verify status of Authority To Proceed (ATP)
- **Launch Services Program Manager makes selection and coordinates with KSC Contracting Officer (CO)**
- **KSC CO awards LSTO for mission launch service**



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Risk Assessment/Evaluation



Launch Service Risk Evaluation:

Overall Assessment: - Given the ground rules in the AO, is the proposed launch vehicle (LV)), standard services, mission-unique services, performance class, costs and concept feasible for this application? (Yes or No)

Areas of risk: _____

LV Performance: Area of risk/concern? (Yes or No)

Proposed LV configuration: _____

Proposed Launch Date: _____

Launch Period (MM/DD/YYYY to MM/DD/YYYY): ____/____/____ to ____/____/____

Launch Window (On any given day of the launch period Minutes:Seconds): ____ : ____

Orbit requirements: Apogee: _____ km Perigee: _____ km Inclination: _____ deg.

High Energy requirements: C3: _____ km²/sec² DLA: _____ deg RLA: _____ deg

Proposed LV Performance: _____

CBE Mass (including reserves) Dry Mass: _____ kg Wet Mass: _____ kg

NTE Mass (including reserves) Dry Mass: _____ kg Wet Mass: _____ kg



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Risk Assessment/Evaluation



LV Performance (cont'd):

Dry Mass Margin: _____ kg _____ %

Wet Mass Margin _____ kg _____ %

Formulas:

Mass Margin kg = LV Performance – S/C Mass (including reserves)

Mass Margin % = [(Mass Margin kg)/ S/C Mass (including reserves) kg] X 100

LV Performance Comments/issues/concerns/risks:

LV Integration: Area of risk/concern? (Yes or No)

Does the proposer have experience in LV integration? (Yes or No)

LV to Spacecraft Interface: Area of risk/concern? (Yes or No)

Proposed Payload Fairing (PLF) _____

Spacecraft (S/C) Dimensions: Radial: _____ m Height _____ m

Any intrusions outside of the AO Baseline PLF usable STATIC volume? (Yes or No)

Are there any special access requirements post-fairing encapsulation? (Yes or No)

If so, list risks: _____



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Risk Assessment/Evaluation



LV to Spacecraft Interface (cont'd):

Mechanical Interface:

Standard Adapter: _____

Custom Adaptor: _____

Electrical Interface: Are there unique electrical interfaces proposed? (Yes or No)

Standard _____ Pin(s) Connector(s): (Yes or No)

Mission-Unique or Non-Standard Requirements:

Instrument T-0 GN2 Purge: (Yes or No)

T-0 S/C Battery Cooling: (Yes or No)

Planetary Protection Requirements: (Yes or No)

Contamination Control Requirements: PLF: (Yes or No)

LV adapter: (Yes or No)

Cleanliness Level: _____ other: _____

List of Mission-Unique or Non-Standard Services proposed that are not part of the AO Baseline launch service offered:

Unique Facility Requirements: (Yes or No)

Pad: _____

S/C Processing Facility: _____



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Risk Assessment/Evaluation



LV to Spacecraft Interface (cont'd):

S/C Environmental Test Plans

Environmental Test Plan/Flow described: (Yes or No)

Test Levels provided: (Yes or No)

Test Schedule provided: (Yes or No)

Comments/issues/concerns/risks:

Launch Service Budget Assessment Summary: Area of risk/concern? (Yes or No)

Are the additional Mission-Unique or Non-standard Services, not included in the AO Baseline service, covered by mission flex funding allocated by LSP? (Yes or No)

If not, list risks: _____

Has additional funding been identified in the PI-Managed Mission Cost (PI-MMC)? (Yes or No)

If not, list risks: _____



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Risk Assessment/Evaluation



Spacecraft Summary Schedule: Area of risk/concern? (Yes or No)

Launch Service Integration time 30+/-3 months? (Yes or No)

SC Environmental Test program end date L-_____mo

Delivery of verified SC loads model delivery to LSP at L-10 months or earlier? (Yes or No)

SC Ship date L-_____mo

SC to LV integrated operations L-_____days

Describe risk of missing the proposed launch date due to spacecraft schedule (environmental testing, launch processing, LV integration): _____

Missions with Radiological material: Area of risk/concern? (Yes or No)

List the Radiological Sources: _____

Are facilities, not already approved for use, required to store/process the Rad Sources? (Yes or No)

Are any LV modifications not included in the AO Baseline service required for additional safety or Launch approval? (Yes or No)

Other identified cost, technical, schedule risks?: Area of risk? (Yes or No)

List Risks: _____
